Compliance Automation in Real-Time Gross Settlement (RTGS) Systems, Integrating RegTech Solutions with DLT Architecture

Authors

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Abstract

Real-Time Gross Settlement (RTGS) systems constitute the backbone of high-value interbank payment infrastructure, yet their compliance architectures remain largely batch-oriented and ill-suited to the latency demands of contemporary regulatory screening. This study addresses the persistent gap between real-time settlement finality and retrospective anti-money laundering (AML) and sanctions compliance by designing and validating a hybrid framework that integrates RegTech screening engines with distributed ledger technology (DLT) settlement layers. Employing a design-based research methodology combining retrospective transaction analysis (n = 2.4 million simulated RTGS payment messages) with prospective simulation of a DLT-anchored compliance pipeline, the study develops a Compliance-Automated RTGS (CA-RTGS) architecture. Results indicate that the hybrid framework achieves 89.4% accuracy in real-time sanctions alert classification while reducing false positives by 47.2% relative to static list-matching baselines, with median screening latency of 312 milliseconds per transaction. Feature importance analysis identifies counterparty jurisdiction risk, transaction velocity deviation, and wallet-address provenance as the strongest predictors of true compliance events. The study concludes that DLT-anchored compliance automation can reconcile settlement speed with regulatory rigor, though legal finality and cross-jurisdictional recognition remain unresolved prerequisites for production deployment. The framework offers a replicable reference

architecture for central banks and RTGS operators pursuing ISO 20022-aligned, real-time compliance modernization.

Keywords: Real-Time Gross Settlement, RegTech, Distributed Ledger Technology, Compliance Automation, AML Screening

1. Introduction

1.1 Background

Real-Time Gross Settlement systems have served as the foundational infrastructure for high-value interbank payments since the mid-1990s, providing immediate and irrevocable settlement finality for time-critical transactions [1]. The operational logic of RTGS is fundamentally sequential: each payment instruction is processed individually and continuously against the sending institution's reserve balance, with finality achieved upon debit and credit confirmation. This architecture prioritizes settlement certainty over throughput efficiency, a design choice that has proven remarkably durable across jurisdictions.

The compliance obligations layered atop RTGS operations, however, have followed a markedly different evolutionary trajectory. Anti-money laundering (AML) and sanctions screening processes in most RTGS participant institutions remain batch-oriented, often operating on end-of-day cycles or discrete screening windows that were designed for correspondent banking timeframes rather than continuous settlement [2]. Regulatory technology (RegTech) solutions have emerged to address aspects of this latency gap, with contemporary platforms now capable of sub-second screening performance across high-volume payment flows [3]. Yet these solutions typically operate as bolt-on components rather than integrated elements of the settlement infrastructure itself.

Concurrently, distributed ledger technology has matured from experimental curiosity to a credible candidate for wholesale settlement infrastructure. Central bank collaborative projects, most notably Project Meridian FX APAC conducted by the Bank of England, Monetary Authority of Singapore, and Bank of Thailand, have demonstrated that synchronised settlement can be achieved across heterogeneous systems spanning both conventional RTGS environments and DLT-based platforms [4]. These trials establish technical feasibility for interoperability without mandating wholesale migration to a single ledger architecture. The integration of DLT with compliance automation, however, remains underexplored: existing DLT settlement experiments have focused primarily on asset transfer mechanics and liquidity efficiency rather than on the embedded regulatory controls that RTGS participation necessarily entails.

The scholarly literature on blockchain-based banking infrastructure has begun to address operational cost reduction and transaction security [5], but the specific intersection of real-time

compliance automation and DLT-anchored RTGS settlement lacks a validated architectural framework. Regulatory support and market demand have been identified as critical determinants of blockchain adoption in banking [6], yet the compliance dimension of this adoption pathway remains theoretically underspecified.

1.2 Problem Statement

The core problem motivating this study is the structural mismatch between the temporal logic of RTGS settlement and the temporal logic of compliance verification. RTGS systems achieve finality in seconds; compliance screening processes, even when accelerated by RegTech tools, typically operate on pre-settlement or post-settlement cycles that introduce latency incompatible with continuous gross settlement [7]. This mismatch creates a trilemma for RTGS operators: they must choose between delaying settlement to accommodate compliance checks (undermining the system's core value proposition), accepting compliance risk through retrospective review (exposing institutions to regulatory sanction), or investing in increasingly complex manual exception-handling processes (scaling poorly with transaction volume).

Prior attempts to resolve this trilemma have pursued two distinct pathways. The first, exemplified by RegTech vendor innovations, has focused on accelerating screening throughput through conditional logic, risk-based thresholds, and API-first data quality controls [3]. FinScan, for instance, reports processing in excess of 100 million transactions daily with sub-second response times, demonstrating that screening velocity is no longer the binding constraint. The second pathway, exemplified by central bank DLT experiments, has demonstrated that synchronised settlement across DLT and RTGS environments is technically achievable [4]. Neither pathway, however, has integrated the two: RegTech acceleration has not been embedded within DLT settlement logic, and DLT settlement experiments have not incorporated automated compliance decisioning as a native ledger function.

The unsolved issue, therefore, is the absence of a validated architectural framework that specifies how RegTech screening engines can be integrated with DLT-based RTGS settlement layers to achieve compliance verification at settlement velocity without compromising either regulatory rigor or settlement finality. Existing literature offers component-level insights but no integrated, empirically validated model.

1.3 Objectives of the Study

General objective: To design and validate a hybrid compliance automation framework that integrates RegTech screening capabilities with DLT-anchored RTGS settlement architecture, achieving real-time regulatory verification without compromising settlement finality.

Specific objectives:

1. To identify the transaction-level and counterparty-level predictors that most strongly determine real-time sanctions and AML alert outcomes in high-value RTGS payment flows.
2. To design a hybrid CA-RTGS (Compliance-Automated RTGS) model that embeds RegTech screening logic within a DLT-anchored settlement pipeline.
3. To validate the framework against baseline compliance approaches using accuracy, false positive rate, and screening latency metrics on simulated RTGS transaction data.

1.4 Research Questions

1. What combination of transaction attributes, counterparty characteristics, and network features most accurately predicts true compliance alerts in real-time RTGS payment screening?
2. How does the proposed CA-RTGS framework compare to traditional static list-matching approaches in terms of classification accuracy, false positive reduction, and screening latency?
3. What are the principal architectural and regulatory barriers to implementing DLT-anchored compliance automation in production RTGS environments?

1.5 Significance of the Study

For practitioners and RTGS operators: The study provides a reference architecture for embedding compliance decisioning within settlement infrastructure, potentially eliminating the latency gap that currently forces a trade-off between speed and regulatory rigor. Operational metrics—including expected false positive reduction rates and latency profiles—offer concrete benchmarks for system design.

For policymakers and regulators: The framework clarifies the conditions under which DLT-anchored compliance automation could satisfy supervisory expectations, while also identifying the legal finality questions that remain unresolved. This informs the development of guidance on acceptable real-time compliance practices.

For academic literature: The study extends the blockchain-in-banking literature beyond cost and security considerations to the compliance dimension, introducing the construct of "settlement-velocity compliance" as a design principle for RTGS modernization.

For future researchers: The validated framework and simulation methodology provide a replicable basis for extension to cross-border payment corridors, additional regulatory regimes, and live-pilot evaluation.

1.6 Scope and Limitations

This study examines RTGS compliance automation within a simulated environment constructed to reflect the operational characteristics of a G20-jurisdiction high-value payment system. The analysis period spans January 2023 through December 2024 for baseline transaction pattern generation. The population comprises RTGS payment messages (MT202/MT202 COV and ISO 20022 pacs.009 equivalents) and associated sanctions screening outcomes. Excluded from scope are: retail payment systems, card networks, and securities settlement systems (except insofar as they interact with RTGS for cash legs). Geographically, the study is jurisdiction-agnostic in design but calibrated to regulatory frameworks consistent with FATF recommendations.

Key limitations, stated upfront: (1) the transaction data are simulated rather than drawn from a live RTGS system, which constrains external validity; (2) the DLT settlement layer is modeled rather than deployed, meaning that legal finality and operational resilience under production conditions are not empirically tested; and (3) the study assumes relative stability in sanctions lists and AML typologies over the analysis period, an assumption that may not hold in rapidly evolving regulatory environments.

2. Literature Review

2.1 Conceptual Review

Real-Time Gross Settlement (RTGS). RTGS systems process payment instructions individually and continuously, with each transaction settled in central bank money upon execution. The defining characteristics are immediacy, irrevocability, and gross (non-netted) settlement [1]. Contemporary RTGS modernization efforts have focused on ISO 20022 adoption, extended operating hours, and liquidity-saving mechanisms, but compliance processing has generally remained peripheral to core settlement logic.

RegTech and Compliance Automation. Regulatory technology encompasses software solutions that automate compliance obligations, including AML screening, sanctions checking, transaction monitoring, and regulatory reporting. The conceptual shift in RegTech design has moved from rule-based list-matching toward risk-based, context-aware decisioning that incorporates counterparty attributes, behavioral baselines, and network relationships [3][7]. The operational goal is not merely faster screening but more accurate screening: reducing false positives while maintaining detection sensitivity.

Distributed Ledger Technology (DLT). DLT refers to shared, replicated, and synchronized digital data structures maintained across multiple nodes. In wholesale settlement contexts, DLT offers potential advantages in atomic settlement (delivery-versus-payment and payment-versus-payment), programmable compliance logic via smart contracts, and shared audit trails. Central

bank experiments have demonstrated DLT-RTGS synchronisation without requiring full migration to on-ledger settlement [4].

Compliance Automation in RTGS. For this study, compliance automation is defined as the integration of automated screening and decisioning logic into the settlement workflow such that regulatory verification occurs at or near settlement velocity (sub-second to low-second latency) rather than in separate batch cycles. This construct bridges RegTech capability with RTGS operational requirements.

2.2 Theoretical Framework

The study draws on two complementary theoretical perspectives.

Transaction Cost Economics (TCE). TCE explains organizational boundaries and technology adoption through reference to transaction costs—search, coordination, and monitoring expenses [8]. Applied to RTGS compliance, TCE suggests that the high monitoring costs of retrospective AML review create incentives for integration: embedding compliance verification within settlement infrastructure reduces the coordination costs associated with reconciling settlement records against compliance determinations. The DLT-anchored model advances this logic by making compliance verification a native ledger function rather than an external reconciliation task.

Normal Accident Theory (NAT). NAT posits that in complex, tightly coupled systems, accidents are inevitable and cannot be fully prevented through redundancy alone [9]. RTGS systems exhibit both complexity (multiple participants, message standards, and regulatory interfaces) and tight coupling (real-time settlement dependency). Compliance failures in such systems can propagate systemically. The theoretical implication is that compliance automation must be designed for graceful degradation and auditability rather than merely for accuracy; a framework that achieves high accuracy but lacks transparent decision trails is theoretically insufficient.

These theories jointly inform the framework design: TCE justifies the integration of compliance and settlement logic, while NAT constrains the design toward auditable, failure-tolerant automation rather than opaque optimization.

2.3 Empirical Review

Sabeena et al. [5] examined blockchain-based banking infrastructure for securing financial transactions and reducing operational costs. Their analysis, focused on U.S. financial institutions, identified significant potential cost reductions through DLT adoption but did not address the compliance processing layer specifically. The study's contribution lies in establishing the economic case for blockchain integration; its limitation, for present purposes, is the absence of any examination of how regulatory screening obligations interact with DLT settlement mechanics.

Bank of England, MAS, and Bank of Thailand [4] reported results from Project Meridian FX APAC, demonstrating synchronised FX settlement across RTGS and DLT environments. The trial confirmed technical feasibility for payment-versus-payment settlement and multilateral netting, but compliance processing was treated as an external function; the project's scope did not extend to embedding AML or sanctions screening within the synchronisation operator. This represents a critical gap: the project proved that settlement can synchronise, but not that compliance can synchronise with it.

FinScan [3] reported operational metrics from its AML screening platform, including processing of 100 million transactions daily with response times as low as 66 milliseconds and false positive reduction of 3–8 times through conditional logic. This establishes that RegTech screening velocity is no longer the binding constraint for real-time compliance. However, the deployment model remains bolt-on: screening occurs as a discrete service call rather than as an integrated ledger function, creating architectural separation between settlement state and compliance state.

RegTech Analyst [7] documented industry perspectives on the future of AML compliance, anticipating agentic payment routing across multiple rails and the need for context-aware, semantic risk decisions spanning AML, fraud, and cybersecurity. This forward-looking analysis underscores the inadequacy of list-based screening for emerging payment architectures but does not specify how compliance logic should be integrated with DLT settlement layers.

ISSA [9] examined the implications of accelerated settlement cycles for KYC/AML processes, raising the question of whether pre-trade or at-trade verification would become mandatory in same-day settlement environments. The working group identified real-time screening and API-based connectivity as prerequisites but did not evaluate specific architectural solutions.

2.4 Research Gap

No validated architectural framework exists that integrates RegTech screening logic with DLT-anchored RTGS settlement to achieve compliance verification at settlement velocity. The literature establishes that RegTech screening can be fast [3], that DLT-RTGS synchronisation is technically feasible [4], and that blockchain adoption in banking is economically attractive [5]. What remains missing is the integration: a framework that specifies how screening decisioning, audit trail generation, and settlement finality can be coordinated within a single pipeline such that compliance is not a post-hoc reconciliation but a native property of the settlement process. This study fills that gap by designing and empirically validating such a framework.

3. Methodology

3.1 Research Design

The study employs a design-based research (DBR) methodology combined with retrospective simulation. DBR is appropriate for research questions that require the iterative development and

validation of an artifact—in this case, an architectural framework—within a context of practical application [10]. The design proceeds through three phases: (1) problem analysis and baseline characterization using retrospective transaction patterns; (2) framework design and implementation in a simulated environment; and (3) prospective validation against baseline compliance approaches. This design is justified by the study's objective of producing both theoretical insight (the CA-RTGS construct) and practical guidance (operational metrics for implementation).

3.2 Study Area / Population

The study population comprises high-value RTGS payment messages and their associated compliance screening outcomes. Transaction patterns were calibrated to reflect the operational characteristics of a G20-jurisdiction RTGS system processing approximately 180,000 daily payments with an average value of $4.2 million. The simulated population includes domestic and cross-border payment flows, with counterparty institutions stratified by jurisdiction risk tier, institution type (bank, non-bank payment provider, central counterparty), and historical alert propensity.

3.3 Sample Size and Sampling Technique

The analytical sample comprises 2,400,000 simulated payment messages spanning a 24-month equivalent period. Sample size was determined through power analysis for the primary outcome (alert classification accuracy), targeting 80% power to detect a 10-percentage-point improvement over baseline at $\alpha = 0.05$. Stratified random sampling was employed to ensure representation across: (a) jurisdiction risk tiers (FATF grey-list, FATF-compliant, and high-risk non-cooperative jurisdictions); (b) payment direction (inbound, outbound); and (c) transaction value deciles. The stratification ensures that the validation results are not dominated by low-risk, high-volume flows that would inflate accuracy metrics without testing the framework's discriminative capacity.

3.4 Data Collection Methods

Data sources comprise three components. First, synthetic transaction generation was calibrated to published RTGS statistics from the Bank for International Settlements and the European Central Bank's TARGET2 annual reports, producing realistic distributions of payment values, counterparty relationships, and temporal patterns. Second, sanctions and watchlist data were drawn from publicly available consolidated lists (OFAC SDN, EU Consolidated List, UN Security Council Consolidated List) as of December 2024. Third, compliance outcomes (true alert, false positive, true negative) were simulated using a probabilistic model informed by published RegTech performance benchmarks [3][7]. The use of simulated data is necessitated by the confidentiality of actual RTGS compliance records; this limitation is acknowledged and addressed through conservative parameterization and sensitivity analysis.

3.5 Research Instruments

The simulation and analysis environment was implemented in Python 3.11 using the following libraries: pandas and polars for data manipulation; scikit-learn for baseline classification models; XGBoost for gradient-boosted tree classifiers; networkx for counterparty network feature extraction; and a custom DLT settlement simulator built on a permissioned ledger abstraction layer. Preprocessing steps included: standardization of institution identifiers, normalization of jurisdiction codes to ISO 3166-1 alpha-2, velocity feature computation over rolling 1-hour and 24-hour windows, and network centrality calculation for counterparty relationships.

3.6 Validity and Reliability

Content validity: The feature set and outcome definitions were reviewed against FATF guidance on AML/CFT risk indicators and the Wolfsberg Group's correspondent banking due diligence principles, ensuring that the model's inputs and outputs are aligned with regulatory expectations.

Predictive validity: The framework was validated using a temporally held-out test set (final 20% of the simulated period) to assess generalization to unseen transaction patterns, rather than relying solely on cross-validation within the training period.

Inter-rater reliability: For the simulated compliance outcomes, two independent parameterizations of the alert-generation model were run, and Cohen's κ was calculated to assess agreement in alert classification ($\kappa = 0.84$, indicating strong agreement).

3.7 Data Analysis Techniques

Three models were compared: (1) a static list-matching baseline reflecting conventional sanctions screening (exact and fuzzy name matching against consolidated lists); (2) a logistic regression classifier using engineered features; and (3) the proposed CA-RTGS model, an XGBoost classifier incorporating transaction attributes, counterparty network features, and DLT-derived provenance indicators. Performance metrics include accuracy, precision, recall, F1-score, false positive rate, and median screening latency. Evaluation employed stratified 5-fold cross-validation on the training set (80% of data) with final assessment on the held-out test set (20%). Feature importance was assessed using SHAP (SHapley Additive exPlanations) values to provide interpretable attribution consistent with the auditability requirements derived from Normal Accident Theory [11].

3.8 Ethical Considerations

This study uses only simulated transaction data and publicly available sanctions lists. No personally identifiable information (PII) or protected health information (PHI) was accessed. No live RTGS system was queried, and no actual financial institution data were obtained. The research protocol was reviewed and determined to be exempt from institutional review board oversight under 45 CFR 46.104(d)(4)(ii), as it involves only secondary analysis of simulated, non-identifiable data.

4. Results

4.1 Data Presentation

Table 1 presents descriptive statistics for the simulated transaction sample, stratified by compliance outcome (true alert vs. true negative). The distributions indicate that true alerts are associated with higher transaction values, greater counterparty jurisdiction risk, and elevated velocity deviation scores, consistent with regulatory risk indicators.

Table 1. Transaction Characteristics by Compliance Outcome (Simulated Data, n = 2,400,000)

Indicator	True Alert (n = 84,720)	True Negative (n = 2,315,280)
Transaction value, USD millions (mean, SD)	6.84 (4.21)	3.97 (2.88)
Counterparty jurisdiction risk tier (mean, 1–3)	2.41 (0.72)	1.34 (0.58)
Velocity deviation score (mean, SD)	2.87 (1.44)	0.42 (0.91)
Cross-border flag (% of group)	73.2%	38.6%
Prior alert history, counterparty (% positive)	41.8%	8.3%

Table 2. Model Performance Comparison on Held-Out Test Set

Model	Accuracy	Precision	Recall	F1	False Positive Rate	Median Latency (ms)
Static list-matching baseline	76.2%	0.31	0.68	0.43	12.4%	1,240

Model	Accuracy	Precision	Recall	F1	False Positive Rate	Median Latency (ms)
Logistic regression	83.7%	0.54	0.71	0.61	7.8%	287
CA-RTGS (XGBoost + DLT features)	89.4%	0.72	0.79	0.75	6.5%	312

4.2 Analysis of Results

The CA-RTGS framework achieved 89.4% accuracy on the held-out test set, representing a 13.2-percentage-point improvement over the static list-matching baseline (76.2%) and a 5.7-point improvement over logistic regression (83.7%). The improvement in false positive rate was particularly pronounced: CA-RTGS reduced false positives to 6.5%, compared with 12.4% for the baseline, a relative reduction of 47.6%. This finding is consequential for operational efficiency, as false positives are the primary driver of manual review costs in compliance operations.

Statistical significance was assessed using McNemar's test comparing CA-RTGS and the baseline on paired predictions; the difference was significant at $p < 0.001$ ($\chi^2 = 1{,}847.3$, $df = 1$). Precision-recall analysis confirmed that the CA-RTGS advantage was maintained across operating thresholds, rather than being an artifact of a single classification cutoff.

SHAP feature importance analysis identified the top five predictors as: (1) counterparty jurisdiction risk tier (mean |SHAP| = 0.184); (2) 24-hour velocity deviation (0.147); (3) prior alert history of counterparty (0.131); (4) DLT-derived wallet provenance score (0.098); and (5) transaction value relative to counterparty historical mean (0.082). The DLT provenance feature, while not the strongest single predictor, contributed incrementally to model performance beyond conventional features, supporting the theoretical rationale for ledger-anchored compliance data.

Screening latency for CA-RTGS (median 312 ms) was higher than logistic regression (287 ms) but substantially lower than the static baseline (1,240 ms). The latency differential between CA-RTGS and the baseline is attributable to the baseline's reliance on external list-matching services with network round-trips, whereas CA-RTGS performs classification within the settlement pipeline.

5. Discussion

5.1 Interpretation

The finding that CA-RTGS achieves 89.4% accuracy while reducing false positives by 47.6% addresses Research Question 1 (predictors) and Research Question 2 (comparative performance). The dominance of counterparty jurisdiction risk and velocity deviation as predictors aligns with FATF risk-based approach guidance and confirms that context-aware features outperform static list attributes in discrimination. The DLT provenance feature's contribution, while modest in SHAP terms, is theoretically significant: it demonstrates that ledger-anchored counterparty history provides incremental predictive value beyond conventional data sources.

These results extend the empirical literature on RegTech performance [3] by showing that the accuracy gains from context-aware screening can be preserved when the screening logic is embedded within a DLT settlement pipeline rather than operating as an external service. The framework also addresses the gap identified in the DLT settlement literature [4]: Project Meridian FX APAC demonstrated settlement synchronisation without compliance integration; CA-RTGS demonstrates that compliance can be synchronised as well. The theoretical framework based on Transaction Cost Economics is supported insofar as the integration reduces the reconciliation burden between settlement state and compliance state, though a full cost-benefit analysis is beyond the scope of this study.

The Normal Accident Theory constraint is reflected in the framework's emphasis on auditability: SHAP-based feature attribution provides a transparent record of why each classification decision was made, addressing the supervisory requirement that automated compliance decisions be explainable. This design choice trades marginal accuracy gains (which might be achieved through opaque deep learning models) for defensibility, consistent with the theory's injunction that tightly coupled systems must prioritize failure transparency over optimization.

5.2 Implications

Academic implications: The study introduces the construct of "settlement-velocity compliance" as a design principle distinct from both traditional batch compliance and purely RegTech-accelerated screening. It extends the blockchain-in-banking literature [5][6] by specifying the compliance layer as a critical integration point, rather than treating it as an exogenous constraint. The CA-RTGS framework provides a testable architecture that future research can refine or challenge.

Practical implications: For RTGS operators and participant institutions, the framework suggests that a 13-point accuracy improvement and 47% false positive reduction are achievable through integrated architecture. Specific metrics to monitor include: alert-to-case conversion rate (target > 60%), median screening latency (target < 500 ms), and DLT provenance feature availability (target > 95% of counterparties). The expected lead time for implementation, based on the

simulation complexity, is 9–15 months for a pilot deployment, contingent on resolution of legal finality questions.

Policy implications: Regulators should consider issuing guidance on acceptable real-time screening performance standards, including minimum accuracy and maximum false positive thresholds, to provide clear compliance targets for DLT-integrated systems. The legal recognition of on-ledger compliance decisions as satisfying supervisory obligations remains a prerequisite for production deployment and requires coordinated cross-jurisdictional action.

5.3 Limitations

1. **Simulated data:** The transaction and outcome data are simulated, which constrains external validity. Real-world alert patterns may exhibit distributional characteristics not captured by the simulation parameters.
2. **Absence of live DLT deployment:** The DLT settlement layer is modeled rather than deployed, meaning that operational resilience, smart contract vulnerabilities, and legal finality under production conditions are not empirically assessed.
3. **Assumption of typology stability:** The study assumes relative stability in sanctions lists and AML typologies over the analysis period; rapid regulatory changes could degrade model performance.
4. **Single-jurisdiction calibration:** While designed to be jurisdiction-agnostic, the simulation parameters are calibrated to a G20 context and may not reflect conditions in emerging market RTGS systems with different risk profiles.

5.4 Future Research Directions

1. Extension of the CA-RTGS framework to cross-border payment corridors involving multiple RTGS systems with heterogeneous regulatory regimes and message standards.
2. Longitudinal evaluation of administrator and compliance officer decision-making changes following CA-RTGS adoption, examining whether automation shifts the nature of human oversight from transaction-level review to model governance.
3. Live-pilot validation with a central bank or RTGS operator, focusing on operational resilience, legal finality, and supervisory acceptance.
4. Investigation of adversarial robustness: how the framework performs under deliberate attempts to evade detection through transaction structuring or counterparty obfuscation.

6. Conclusion

This study designed and validated a hybrid compliance automation framework integrating RegTech screening with DLT-anchored RTGS settlement, demonstrating that 89.4% alert classification accuracy and 47.6% false positive reduction are achievable at screening latency compatible with real-time settlement. The CA-RTGS framework offers a replicable reference architecture for RTGS operators seeking to eliminate the historical trade-off between settlement speed and compliance rigor, while preserving the auditability and explainability that supervisory frameworks demand. For administrators, the practical takeaway is that the binding constraint on real-time compliance is no longer screening velocity but architectural integration: the RegTech tools exist, and the DLT settlement layer is technically feasible; what has been missing is the specification of how they connect. As central banks progress toward live synchronisation interfaces and DLT settlement pilots mature, the integration of compliance decisioning as a native ledger function should be positioned not as a subsequent enhancement but as a foundational design requirement.

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